

Teaching scientists to be citizens

It is hard to become a good scientist. It is even harder to become a good citizen.

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Deep in the German forests above Heidelberg, the European Molecular Biology Laboratory (EMBL), in its infancy in the late 1970s, was a haven of basic research and serenity. I remember hard experimental work, intensive discussions and unexpected ideas emerging along the wooded paths. On a recent visit, I saw that the busy buzzing of EMBL has by no means receded. But I also saw that EMBL is changing. The explosive growth of the parking lots and the new buildings for commercial companies are reshaping the glade; scientists are sitting behind their computer screens most of the time; there are more females than males; last summer, the temperature broke another record high. And, probably much more important, the scientists working there are becoming aware that there is a world outside the laboratories. It started with rumours rising from the valley that first reminded us that a wider world was bubbling not far away. We were amazed at the gossip reported in the local press that clover, growing around the Laboratory, had a suspicious number of leaves because of some mysterious genetic manipulations. We were shocked when the media widely covered the claim made by an East German scientist that AIDS was a product of the US Secret Services. Nowadays, news about cloning, stem-cell research, bioterrorism and the turbulence of the stock market is pouring in daily.

Biologists know about change. For more than 3 billion years, life has undergone changes, and no one would be here to witness anything if evolution had not been hard at work. But the changes that are now occurring are different, because they are anthropogenic and because they are happening increasingly rapidly. And they are not met with enthusiasm by everyone: "Stop improving things!", an

angry hand had written on the door of the computer room. Indeed, many changes in the world give ample cause for worry. But there are also plenty of changes that raise hope. Fifty years ago, in my village in the Swiss Alps, our proud democratic country was treating women in a way reminiscent of the darkest face of Islam. Thirty years ago, the same women were not allowed to vote. What a favourable change has happened since then. During this time, the incidence of illiteracy in the world and the population growth rate have been greatly reduced, whereas the proportion of people living in democratic societies has massively increased, as has the role of women in public affairs. As scientists, we are also sensitive to the huge increase in knowledge and to our improved ability to act for the good of our environment and ourselves. For the first time, human society is in a position to provide healthy food, good education and high-quality health-care to everyone in the world, and we could probably do it in a sustainable way.

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We could ... but we do not. Why? Because *Homo sapiens* is selfish, aggressive and power hungry. Because he is of limited intelligence and his ability to think beyond his immediate needs and his narrow cultural world is limited. But this is only one side of the argument—like Janus, man has two faces. He can also be

empathic, and he can communicate. He likes to share with his fellow men what is good for him. Above all, he can think in the abstract, extending his thoughts and feelings, apparently without limit. And sometimes, even his sympathy seems to be without bounds. Recently, while trekking along a remote coast on the other side of the world, my friend and I observed a fisherman by his primitive home, cleaning his catch. The man looked at us and threw the fish towards us; some hours later, we were still sitting around the fire with the fisherman and his family. We all anticipate such enriching personal encounters as this, as much as we like to hear stories of good men whose actions have shaped history.

Of the two faces of Janus, why does man not always show the good one? Perhaps an element of the answer is that man is simply unaware of his abilities and what to do with them. There is a question I like to ask people point blank: "What is the main value in your life?" One would imagine that most would know their answer. This is not the case. In general, they reply "wah", "boof" or "interesting question!" Only once did I receive a straight "my family". Of course, I thought long and hard about what would be my own answer and found it to be "Liberté, Égalité, Fraternité". It is not very original; others have had the idea before. But in fact, the vast majority of people come to a similar conclusion, whether they are European, Chinese, a Tasmanian fisherman or a North American scientist.

Actually, biologists could be experts in answering this question because we are experts in life, and many of us are specialized in human biology. However, when biologists address the questions "What is

the main value in life?" and "What should man be?", the results have been horrifying on many occasions (Müller-Hill, 2002). We have certainly learned from past catastrophes, but the debate is gaining importance as biological knowledge increases. *The Bell Curve* (Herrnstein & Murray, 1994; see also Sternberg, 1995), a best-seller about the importance of heredity for social organization, exemplifies this ambiguity of scientists. Building on a solid methodological introduction, the authors present abundant data about intelligence and socio-cultural parameters, such as incomes and crime rates. Their analysis culminates with a political programme that asks for, among other things, zero tolerance of crime and suppression of social help for one-parent families. While reading the book, one is rapidly convinced that the authors are competent scientists; they are clearly experts in their field. But the book is not just about science, it is also about politics. The authors are selecting facts and developing arguments to support their political agenda. From the same scientific data, others could draw different conclusions, as is illustrated by the tale of the two fathers who were asked to name their favourite child. One replied: "It's Richard, because he is brilliant and will bring great rewards to his old parents." The other said: "The closest to my heart is Modest, because life is the hardest for him."

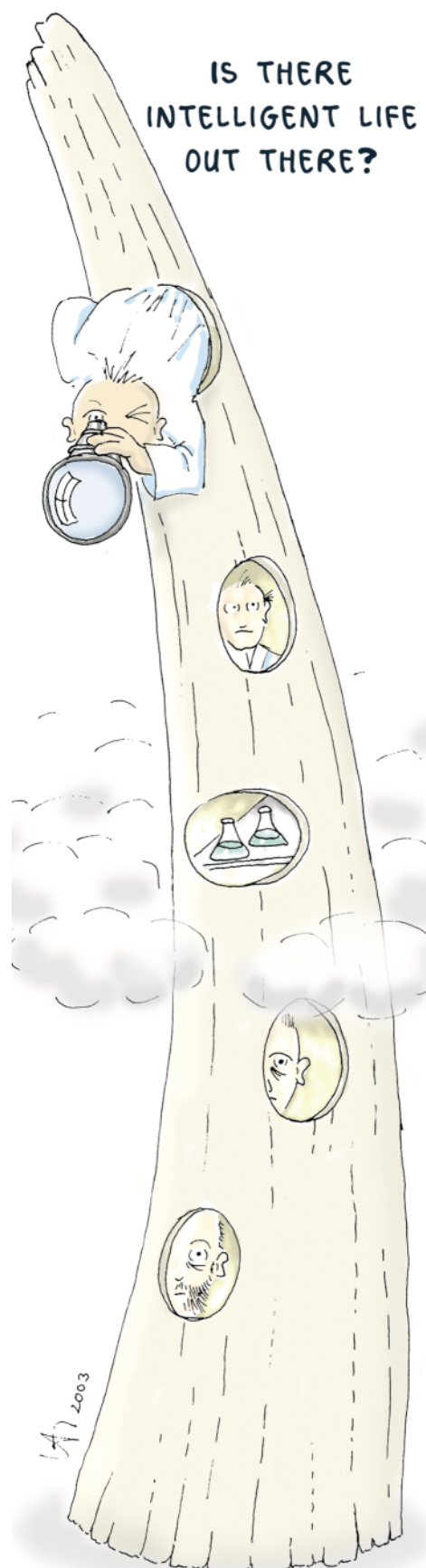
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When it comes to the main values in life, or to what should be done with our newly acquired knowledge in biology and medicine, the answers are not scientific but political in nature. And it is the very essence of democracy that citizens should decide such questions, not scientists. Science can certainly help to clarify the debate, but it cannot and should not impose solutions, because scientists are citizens and, as citizens, they are not any different from other people. But the role of the scientist in the political debate is polluted by the ambiguity between his specialized scientific knowledge and his unspecialized position as a citizen. We

can all recall public declarations in which a colleague presumptuously presented the social advantage of his or her latest finding. We also wonder about Craig Venter's new career as an ethical philanthropist (Butler, 2002). Consciously or not, we are cultivating this ambivalence. Sometimes, it seems to confer to the citizen some of the objective competence of the scientist. However, this is generally fallacious, and even if it can deceive some people for some time, in the long term it certainly erodes the credit of both the scientist and the citizen.

Physics had its golden years at the beginning of the twentieth century, terminating with the Second World War and the use of physics by the military. Biology's heyday, in the second half of the last century, was characterized by unlimited research, discovery and amazement. This time has faded away with the end of the century and with the growing importance of business, military applications of biological research and the menace of bioterrorism. Nowadays, it should be clear to every biologist that research can no longer be done without considering its consequences. The time of the ivory tower is over. Scientists can no longer escape their role as citizens. The trouble is that, although being a good scientist is a difficult job, being a good citizen is probably harder. We learn our scientific profession with great seriousness and at length, and our progress is steadily controlled. This is not the case for our 'profession' as a citizen. In this field, each of us acquires such competence with little external incentive, no examination and hardly any feedback. All together, the results are not good. Are we all familiar with the Universal Declaration on the Human Genome and Human Rights (UNESCO, 2002)? Are we aware of the situation between public and private genome-sequencing programmes (Olson, 2002)? Do we know about efforts made to preserve our rights over what we publish (Public Library of Science, 2002)?

Being a good citizen-biologist requires a little bit of philosophy and history, plus some knowledge of economics and law. The big advantage of citizenship over biology is that it does not require broad factual knowledge; it mostly requires common sense. But overall, it requires us



to think. And this is not so hard to teach, at least not as hard as biology. For many years, the University of Lausanne has organized a series of seminars about biological and medical ethics for students and teachers of science, medicine, theology and law. Except for a few hours during which the basic concepts are presented, the course studies concrete situations, generally proposed by a staff member or an invited person. Predicting breast cancer, research into stem cells and "Who should represent endangered species?" are some examples. A multidisciplinary group of students takes care of each case and presents it to the audience, leaving plenty of time for discussion. It takes more than one course to acquire a broad and solid understanding of ethics, but every participant rapidly appreciates the need for this knowledge. One interesting observation is that even those who propose the cases, and who should therefore be experts in the field, also profit from the exercise, because most of them have had little occasion to think about their problem in a framework outside their own speciality. The course was optional until last year. From now on it will be compulsory (Bioéthique, 2003), and it is included in a programme (Département Interfacultaire d'Ethique, 2002) ensuring that every student is exposed to ethics for the whole duration of their studies. The hope is that graduate students will become not only knowledgeable biologists, but also mature citizens.

The other competence required of a good citizen-biologist is the ability to communicate. However, this has recently been misrepresented. What the public, understandably, would like to know is: how will a scientific finding directly affect me? In this respect, communication with the public does not require so much a "public understanding of science", but a "scientific understanding of the public". This was recently shown, again in Switzerland, during a confrontation between scientists and a federal office about a request to test transgenic wheat in open field trials. The root of the problem was that the scientists were addressing the specific safety problem of the given experiment, whereas the federal administration was sensitive to the broad anxiety of the population about transgenic organisms. With such different priorities, the ensuing

clash was inevitable. Understanding public concerns is not an easy task, and offering constructive solutions is even more difficult. More than ten years ago, some scientists of the University of Lausanne formed the group IMédia to experiment with different approaches to reach out to the public (Dubochet, 2001; IMédia, 2002). Because of the broadness of the task, the group was rapidly extended to include media specialists, sociologists and psychologists. Furthermore, with the recognition of the importance of their work, the driving force in the group changed from good-willing amateurs to full-time professionals. Under these conditions, how is it possible to make sure that the original goal is preserved? Keeping in mind the basic values of life that need to be promoted is certainly the most important prerequisite.

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Promoting social responsibility among scientists has become an important issue in many universities and research institutions. In this respect, I feel that the USA is a long way ahead of us Europeans. Various solutions to the complex problems of science in society are experimented with, resulting in more or less success. In the glade of Heidelberg, creative groups at EMBL and EMBO are joining efforts to work in complementary directions. The recent initiative for a European Learning Lab for Life Sciences (EMBL, 2003) is an example in which secondary-school science teachers are participating in workshops with research scientists. This has been set up in a dedicated laboratory at EMBL and in various European Union Member States. Not every member of the laboratory actively contributes to these initiatives. Some are still surprised when these 'tourists' invade the laboratory for a moment, or when a speaker invited by the Science and Society Group is promoting opinions that are perhaps close to those of the public, but far from in-house thinking. Nevertheless, these efforts to bridge the gap between scientists and citizens are exemplary. They deserve the same support

as fundamental research, because the harmonious development of our society is at stake.

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